

# **Temporal evolution of particles and plankton distributions across a mesoscale front during the spring bloom**





# Describe community dynamics during the *bloom* over a *front*

## What we know

Bloom in **Feb-March**

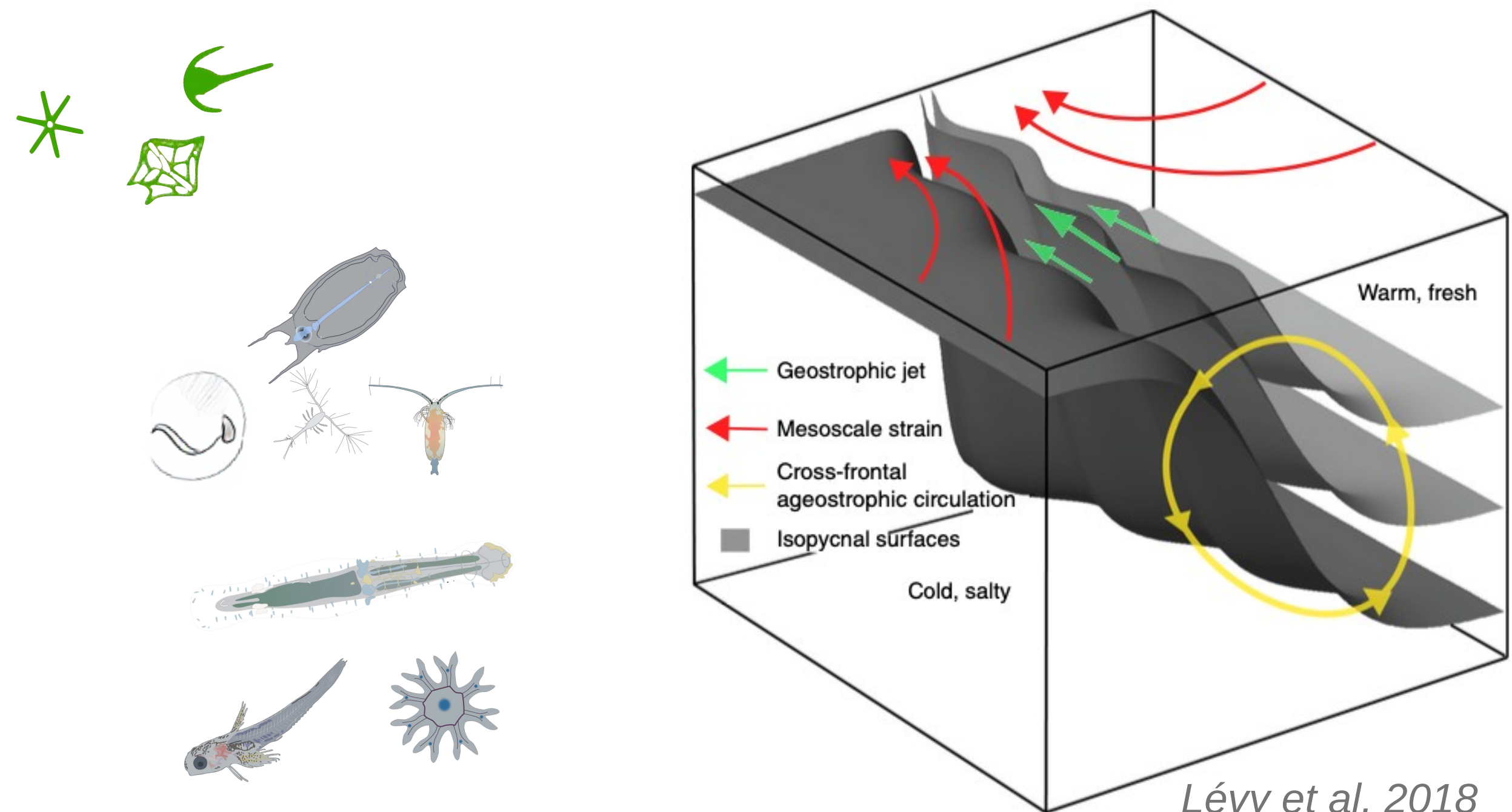
**Succession:** phytoplankton → zooplanktonic grazers  
→ zooplanktonic predators

Ends with stratification, **oligotrophy** of surface and creation of Deep Chlorophyll Maximum

**Permanent** front, including **submesoscale** recirculation

**Increased** productivity and/or aggregation

Constrains **particle** distribution possibly **plankton**





# Needs

Okm resolution

several months

biogeochemistry →  
zooplankton

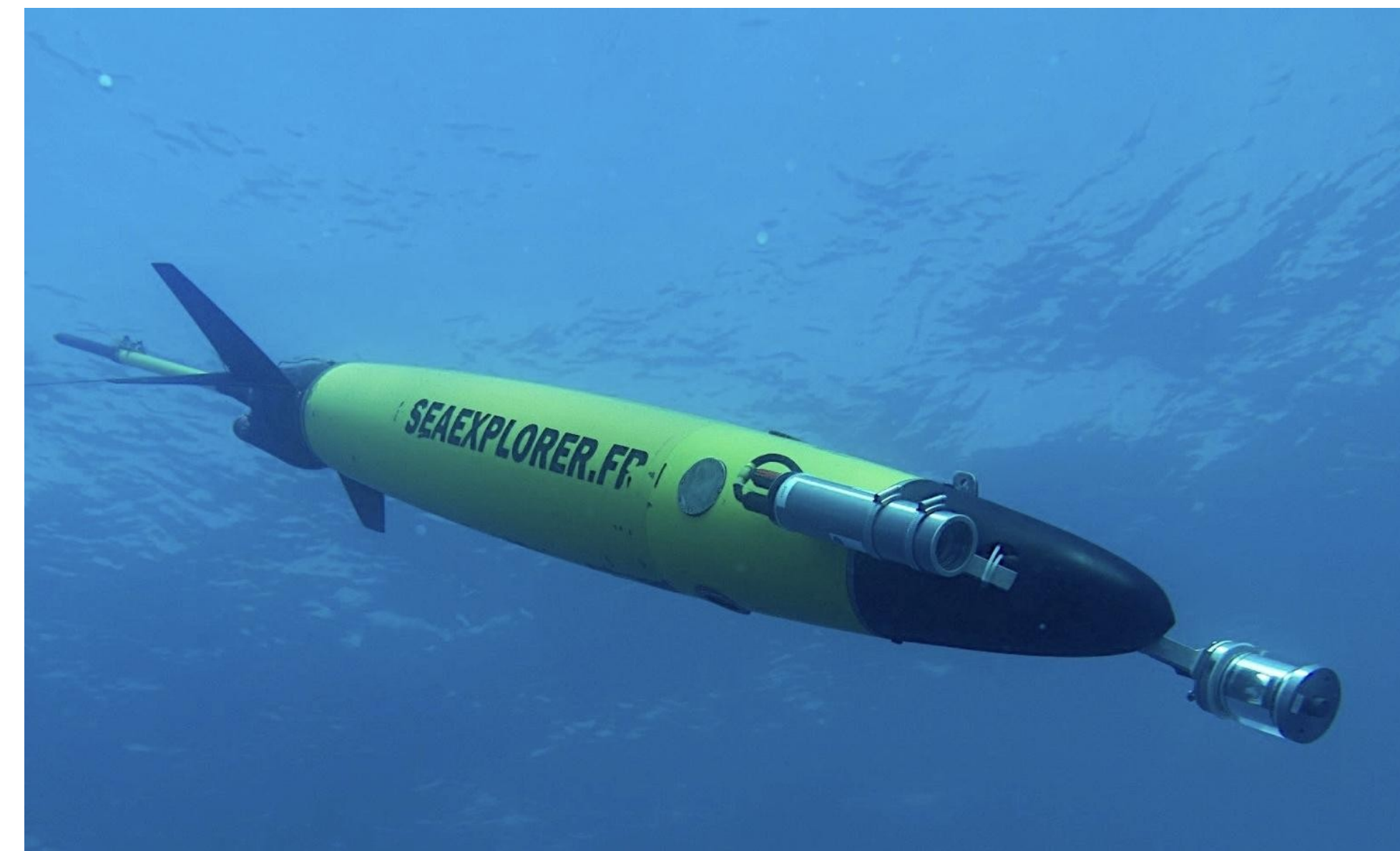


## Glider + UVP6

T°, sal

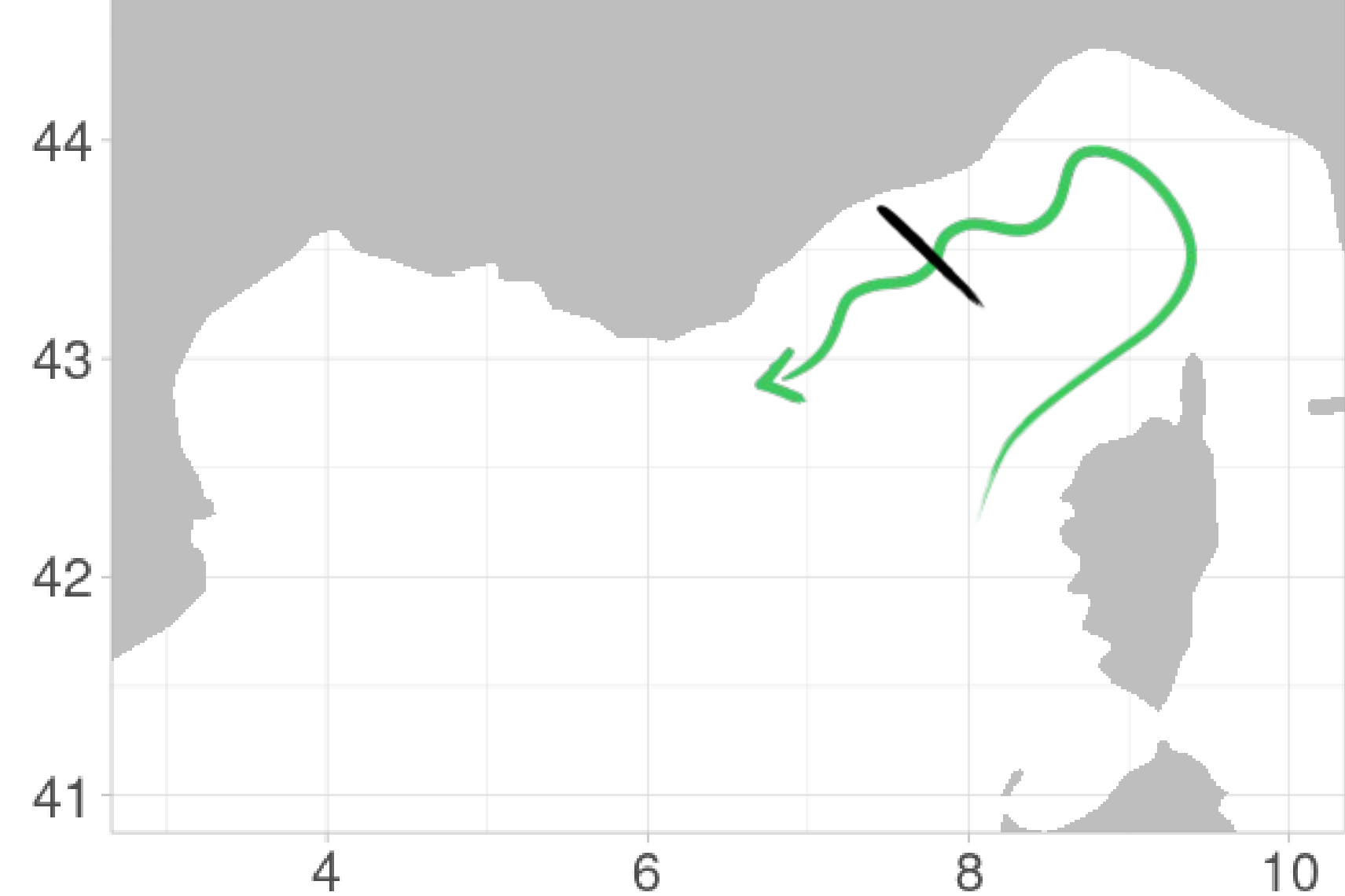
O<sub>2</sub>, Chl a, CDOM, BB700

UVP6 LP  
particles > 80 µm  
organisms > 0.6 mm





# Sampling strategy



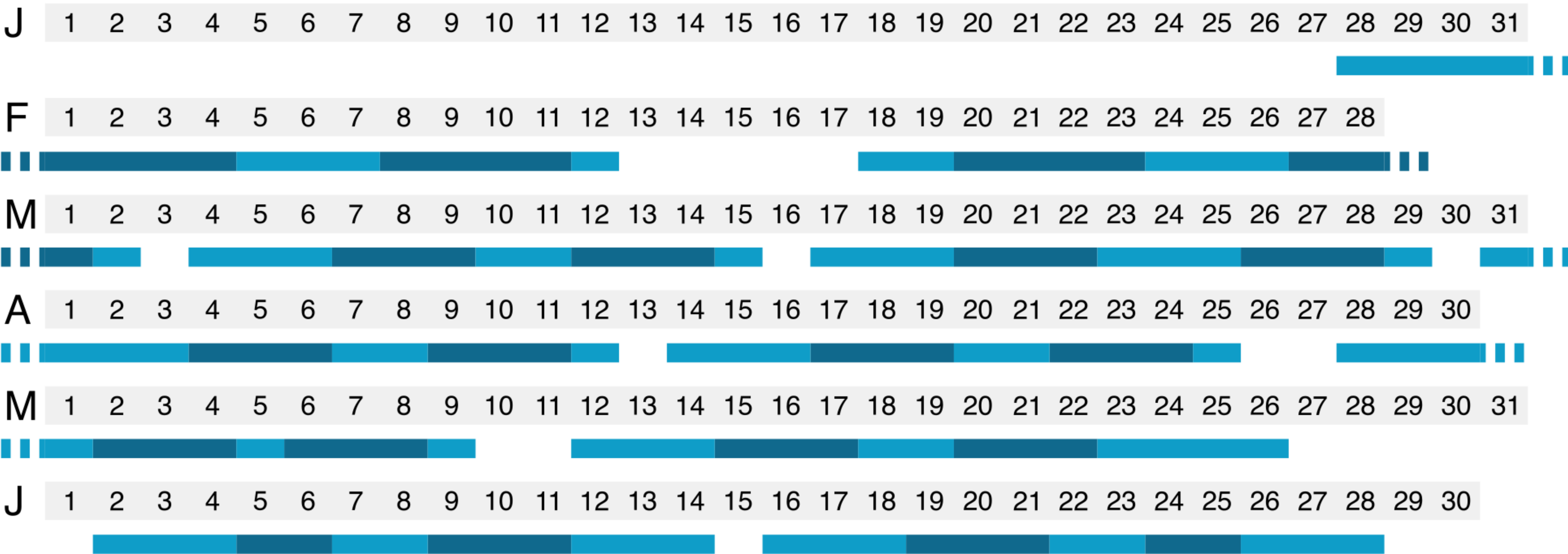
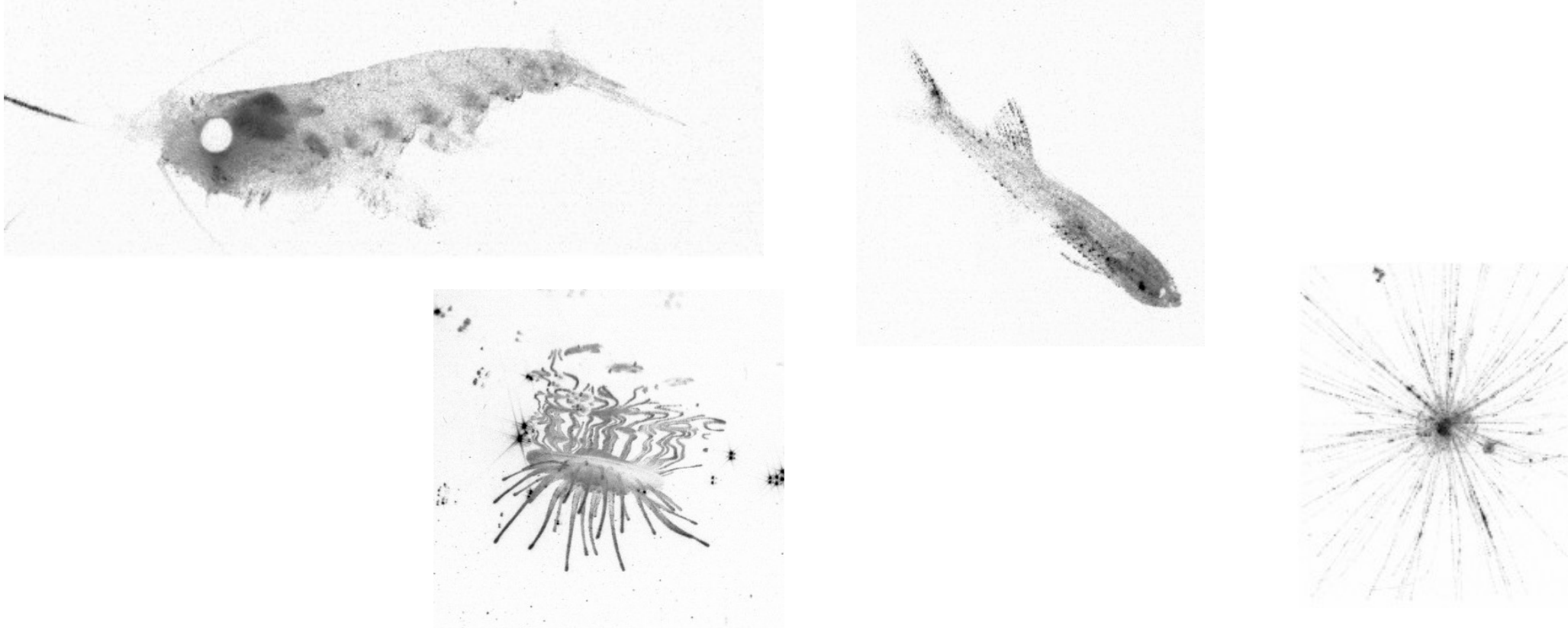
Ligurian  
current





# Glider campaign overview

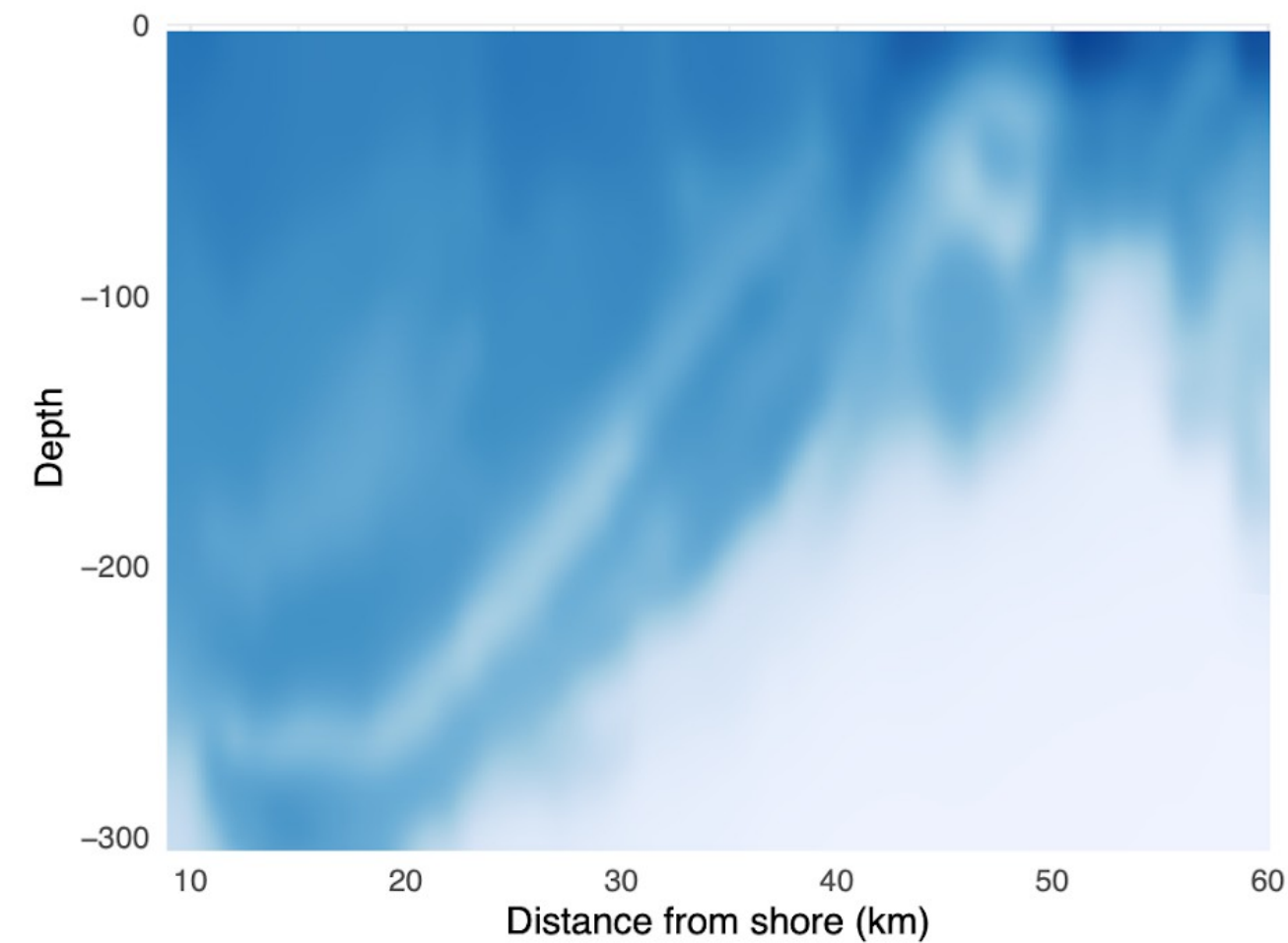
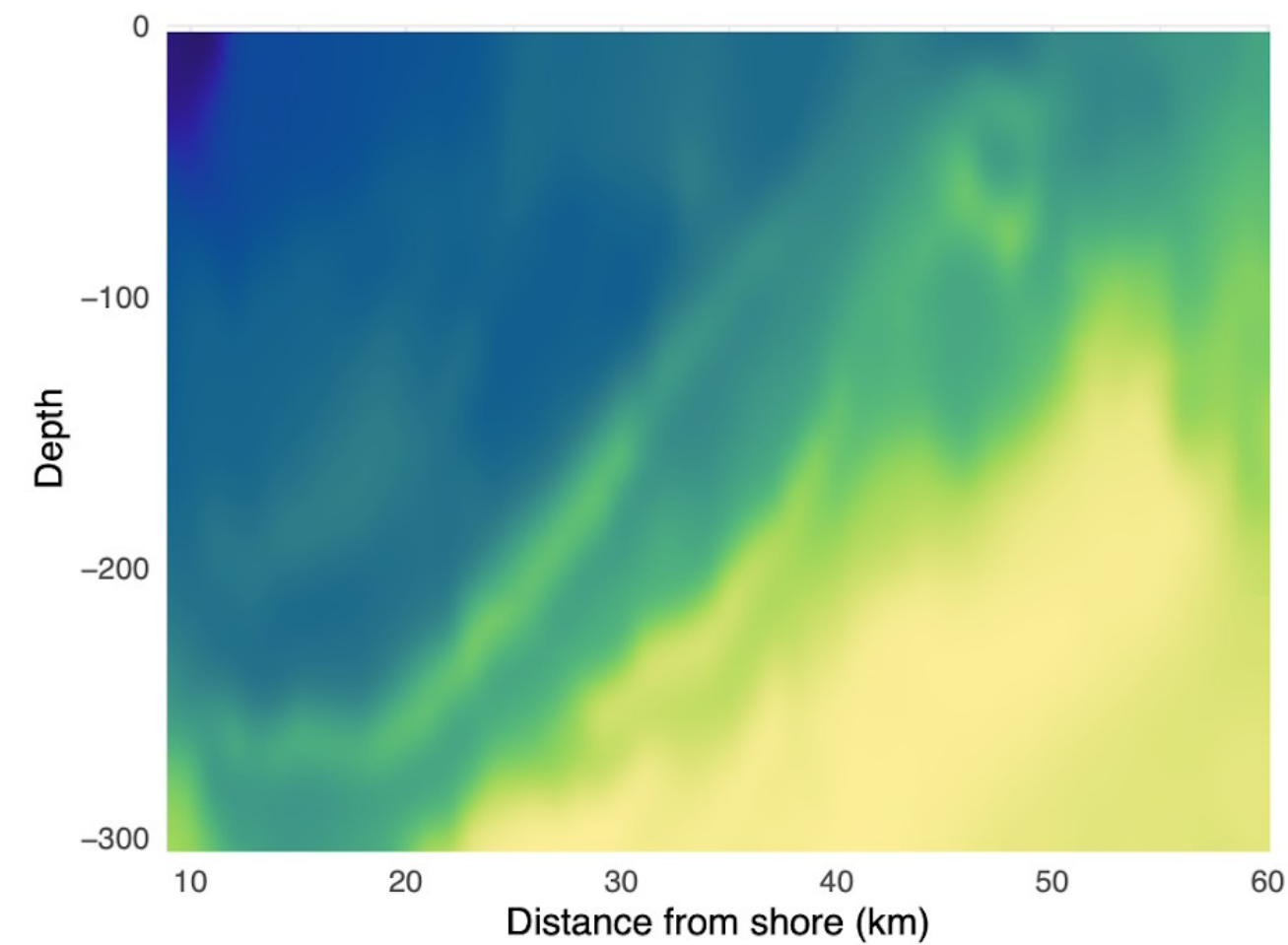
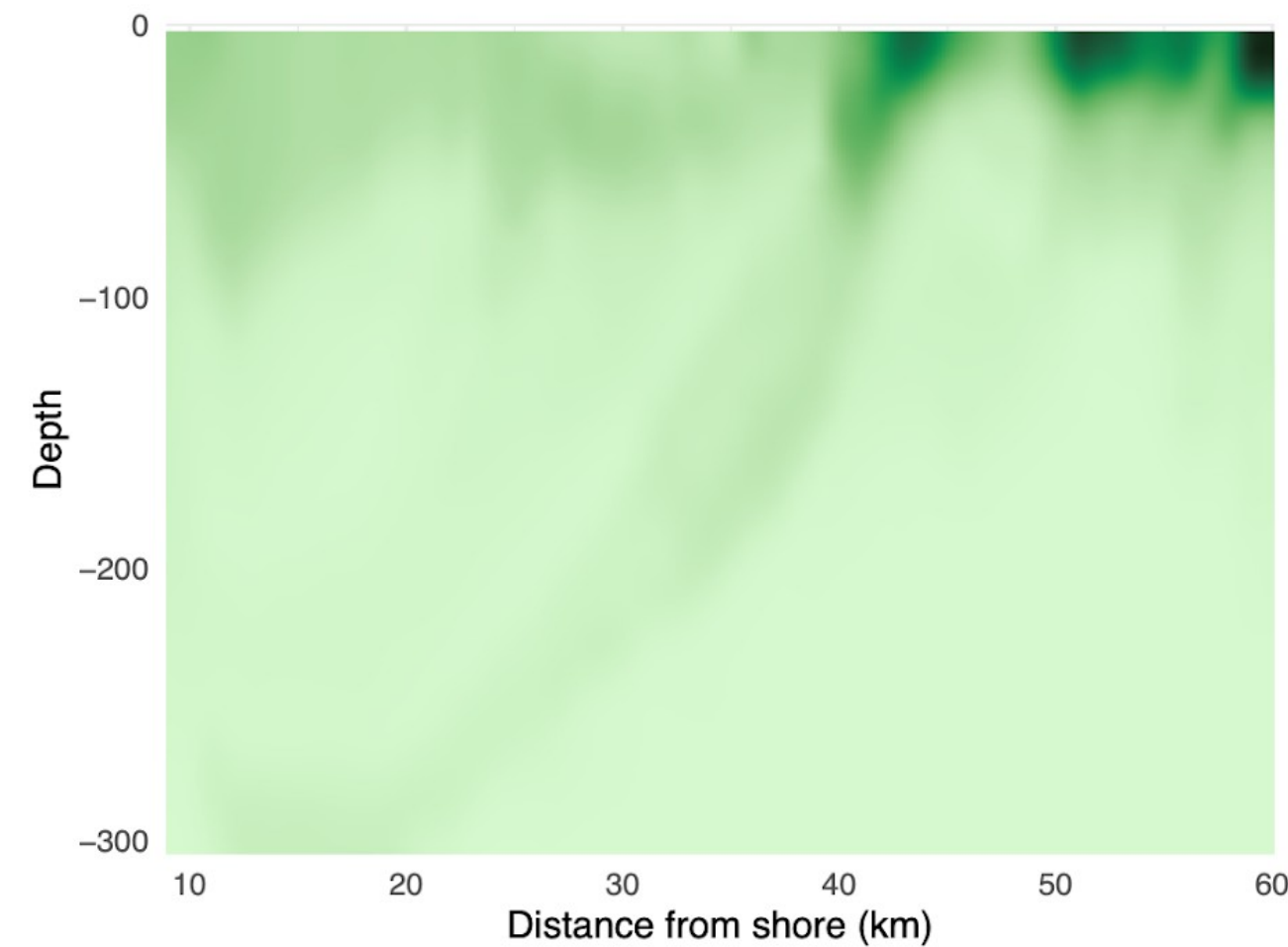
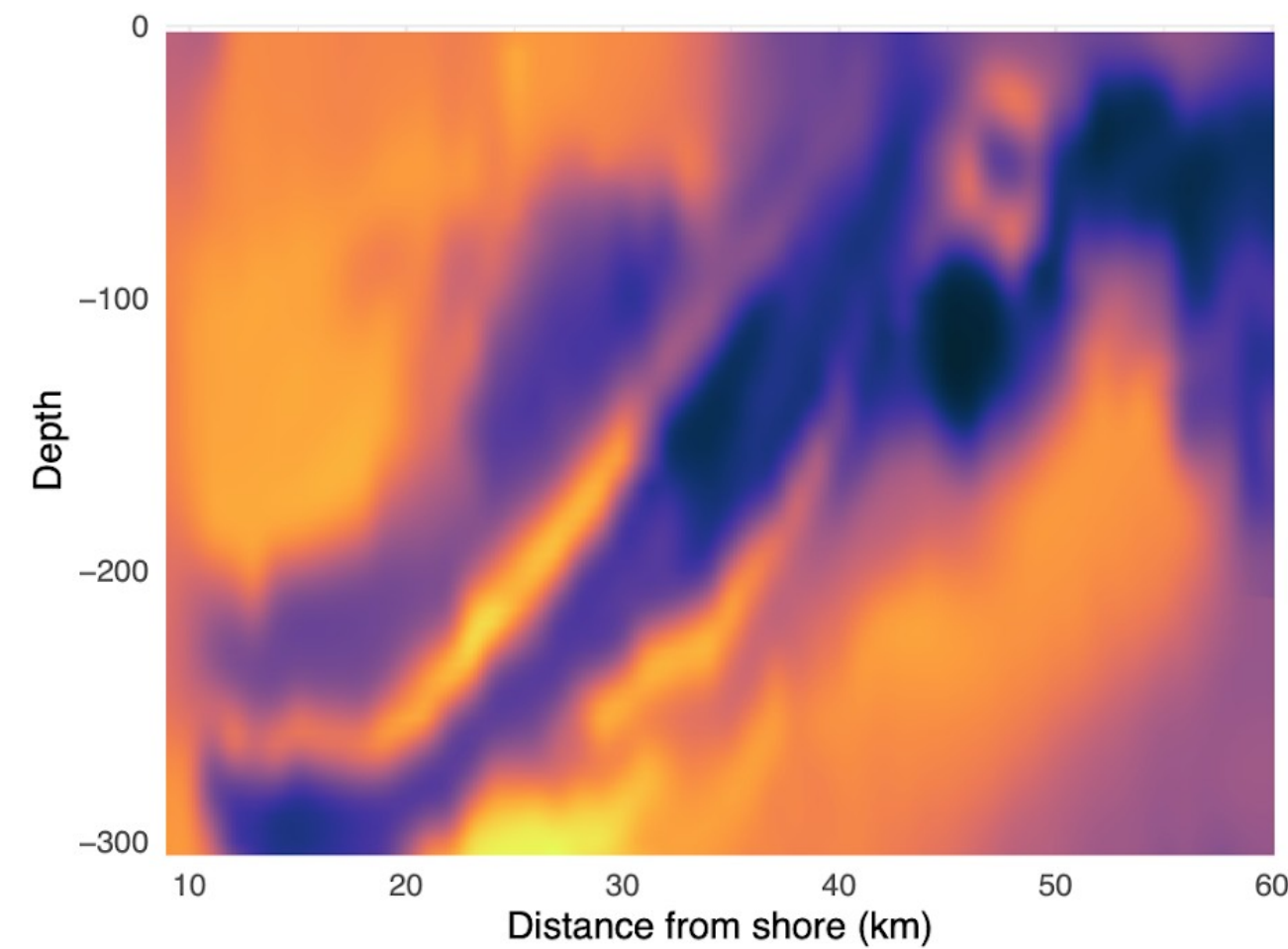
5000 profiles  
1.1 million images



out back



# Biogeochemical data



Some sensors result in quite **noisy** data

Filter out outliers, despike through moving median

Bin 5 m depth

Smooth through moving average

**Interpolate** over the whole domain  
(200 m in x, 0.5 m in y)

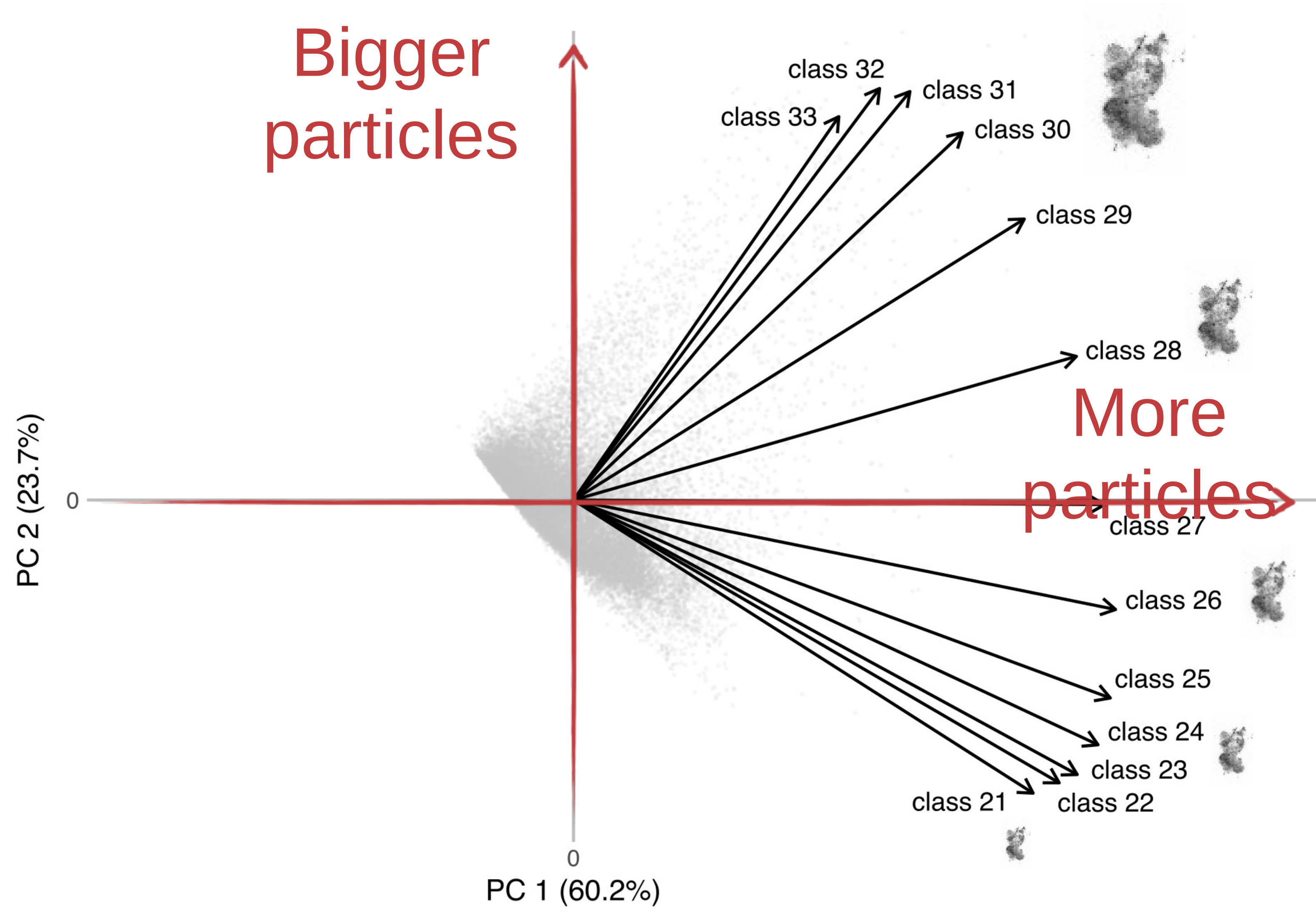


# Particle data

13 particle **size classes**

**PCA** on log-transformed particle concentrations

**Summarised** by the first two components





# Plankton data

# Machine Learning predictions + Morphocluster and EcoTaxa

13,000 planktonic organisms = concentrations on 20m × 5km bins

## MorphoCluster

**Node members (2174 objects)**

**139164**  
  
c\_m139\_045  
2986.387m

**62729485**  
  
5 mm  
c\_m139\_045  
686 7.8 m

**67114880**  
  
5 mm  
c\_m139\_045  
2986.387m

**62040492**  
  
5.0 mm  
c\_m139\_045  
776 7.4 m

**64986342**  
  
5 mm  
m96\_004  
7994 1133.1 m

**67640376**  
  
5 mm  
c\_m139\_045  
1582.7 m

**Recommended members (Page 640 / 2000)**

**62039899** ✕ ✓  
  
5.0 mm  
c\_m139\_045  
9865 823.5 m

**64984232** ✕ ✓  
  
5 mm  
m96\_017  
244 14.6 m

**67764659** ✕ ✓  
  
5 mm  
c\_m139\_045  
2518.379m

**61816039** ✕ ✓  
  
5 mm  
83  
1138 1.3 m

**62148043** ✕ ✓  
  
5.0 mm  
c\_m107\_017  
1566 180.6 m

**63691038** ✕ ✓  
  
5 mm  
c\_m139\_127  
785 18.5m

☐ Turtle mode
 ☒ OK
 ☒ Not OK

## EcoTaxa 2.6

Project ▼ Filtered ▼ (0, 61208, 0, 0 / 61208)

Filter: Taxo=living (with child) ✕ Status=Predicted ✕

Update view & apply filter

Taxonomy filter ? Other filters

like<Copepoda

- Actinopterygii 115 18
- Annelida 46 87
  - Alciopidae 13 34
  - Phyllodocida 13 84
  - Swima 42 238
  - Tomopteridae 14 235
- Appendicularia 26 107
  - house 199 10616
- Chaetognatha 12 12
- Cnidaria < Metazoa 2
- Hydrozoa 13 1
  - Narcomedusae 37 3
  - Siphonophorae 19 43
  - Trachymedusae 1
- tentacle < Cnidaria 215 1551
- Copepoda 724 9059
  - Calanidae 11 17
  - copepoda eggs 202 1247
  - like < Copepoda 1857 18332
- Ctenophora < Metazoa 18 19
- Echinodermata 1 50
  - pluteus < Echinoidea 3
  - pluteus < Echinodermata 15
- Eumalacostraca 240 3537
- Amphipoda 83 339
- Hyperiidae 1 1

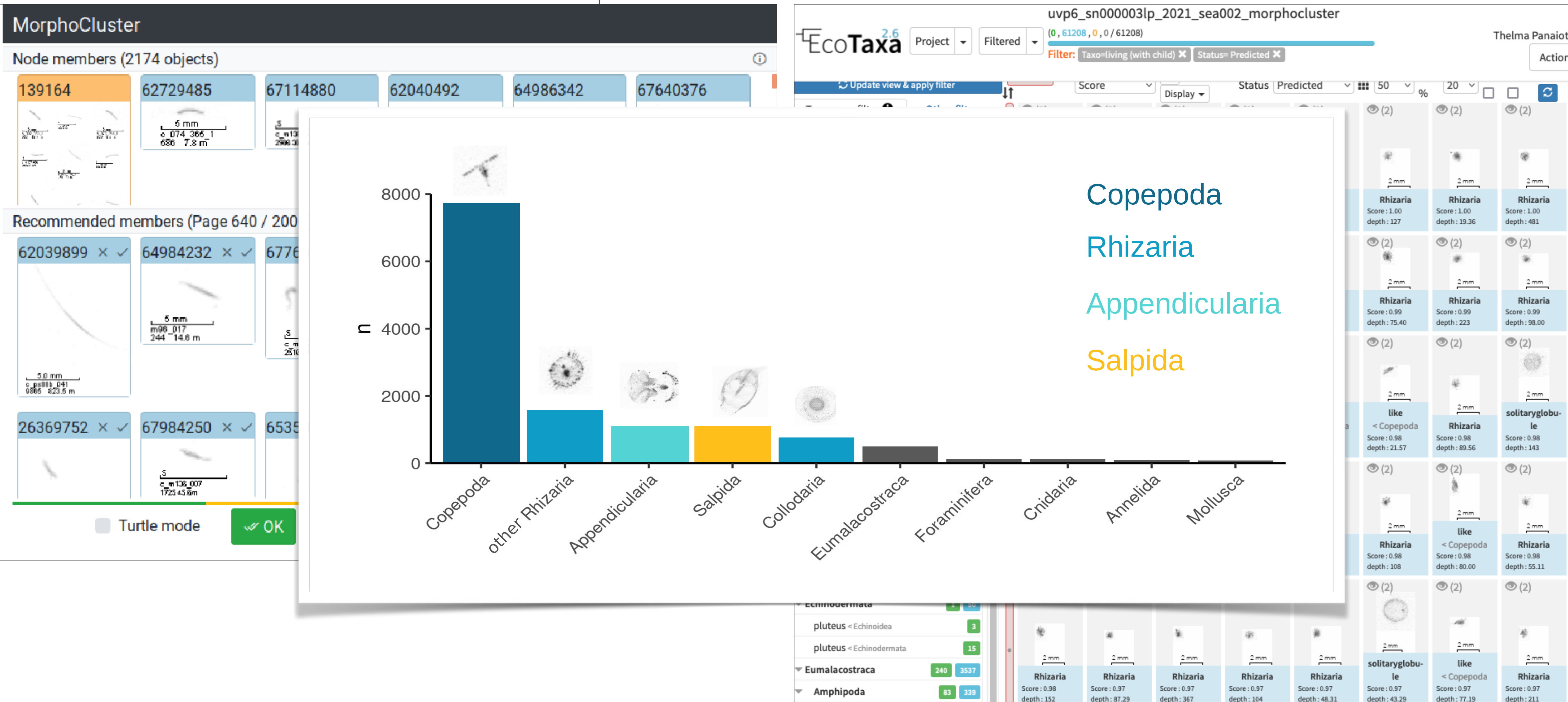
Score	Display	Status	Predicted	50 %	20 %			
solitaryglobu- le Score: 1.00 depth: 79.97		Rhizaria Score: 1.00 depth: 118		Rhizaria Score: 1.00 depth: 83.53		Rhizaria Score: 1.00 depth: 102	Rhizaria Score: 1.00 depth: 116	Rhizaria Score: 1.00 depth: 127
Rhizaria Score: 0.99 depth: 546		Rhizaria Score: 0.99 depth: 91.04	Rhizaria Score: 0.99 depth: 113	Rhizaria Score: 0.99 depth: 88.64	Rhizaria Score: 0.99 depth: 89.36	Rhizaria Score: 0.99 depth: 75.40	Rhizaria Score: 0.99 depth: 223	Rhizaria Score: 0.99 depth: 98.00
Rhizaria Score: 0.99 depth: 94.28		Rhizaria Score: 0.98 depth: 412	Rhizaria Score: 0.98 depth: 207	Rhizaria Score: 0.98 depth: 91.64	like < Copepoda Score: 0.98 depth: 157	like < Copepoda Score: 0.98 depth: 21.57	Rhizaria Score: 0.98 depth: 89.56	solitaryglobu- le Score: 0.98 depth: 143
Rhizaria Score: 0.98 depth: 176		Rhizaria Score: 0.98 depth: 100	Rhizaria Score: 0.98 depth: 137	Rhizaria Score: 0.98 depth: 57.11	Rhizaria Score: 0.98 depth: 170	Rhizaria Score: 0.98 depth: 108	like < Copepoda Score: 0.98 depth: 80.00	Rhizaria Score: 0.98 depth: 55.11
Rhizaria Score: 0.98 depth: 152		Rhizaria Score: 0.97 depth: 87.29	Rhizaria Score: 0.97 depth: 367	Rhizaria Score: 0.97 depth: 104	Rhizaria Score: 0.97 depth: 48.31	solitaryglobu- le Score: 0.97 depth: 43.29	like < Copepoda Score: 0.97 depth: 77.19	Rhizaria Score: 0.97 depth: 211



# Plankton data

# Machine Learning predictions + Morphocluster and EcoTaxa

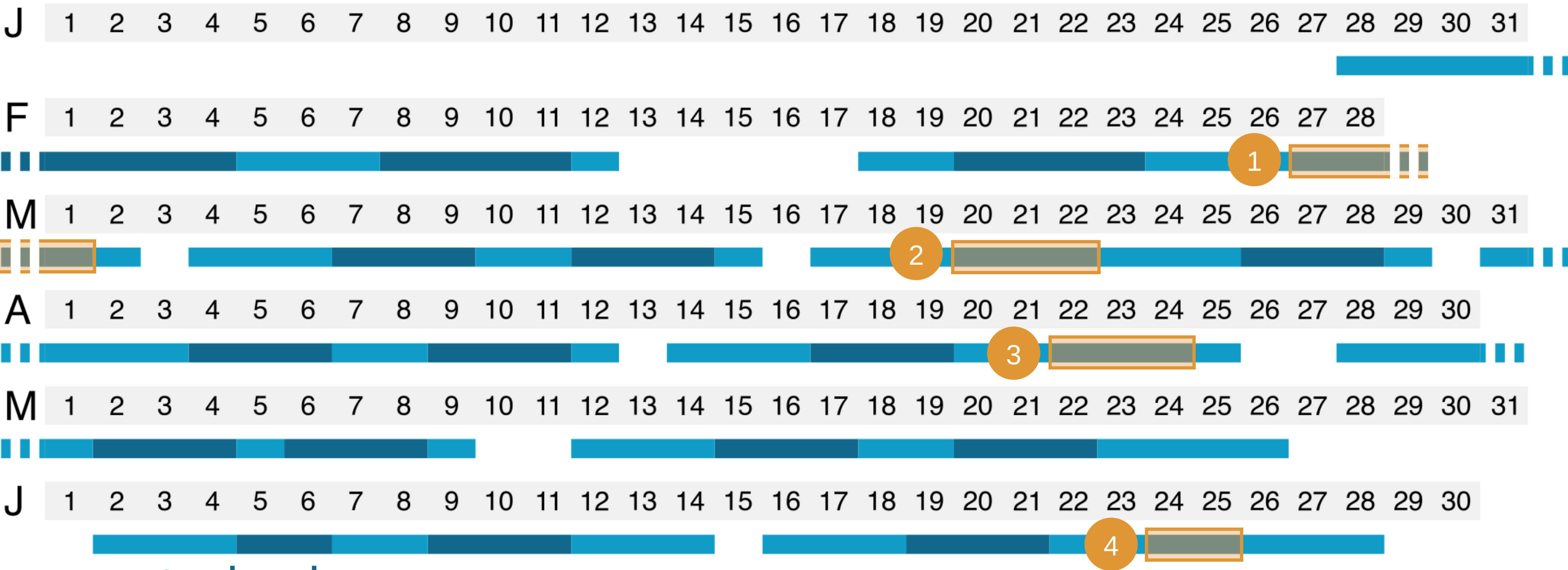
13,000 planktonic organisms = concentrations on 20m × 5km bins





# Selection of transects

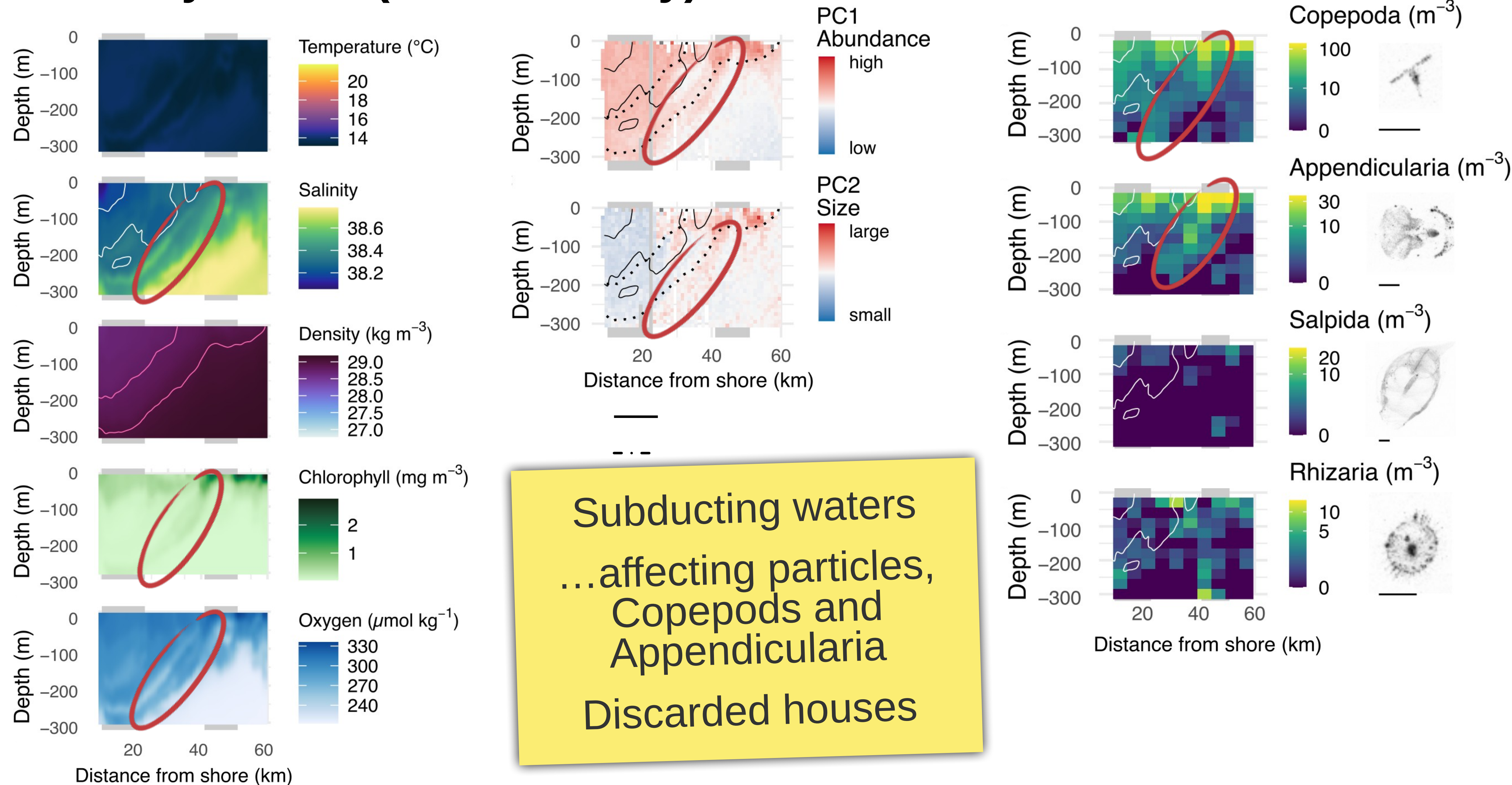
1: early bloom    2: mid bloom    3: late bloom    4: post bloom



out back

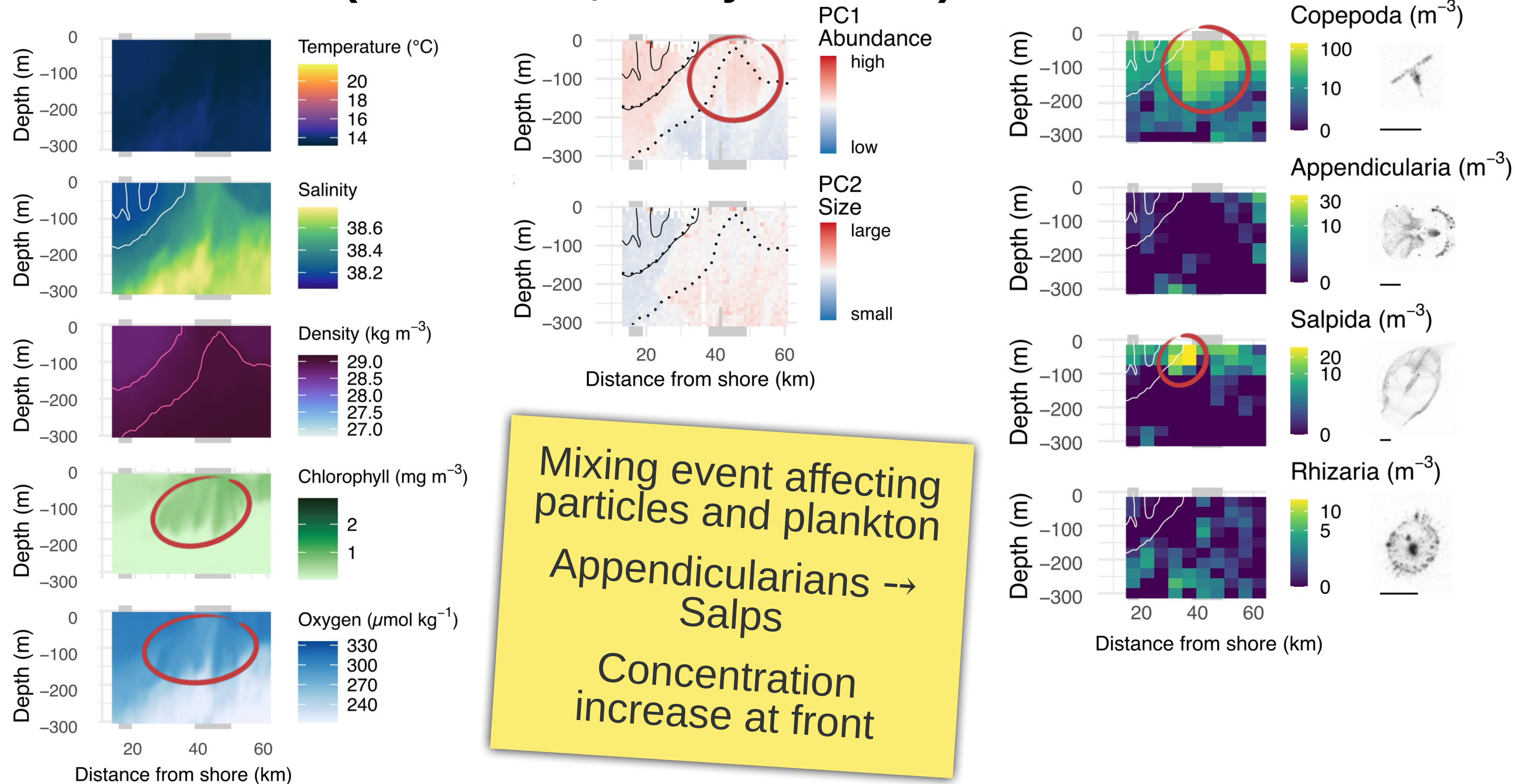


# 1: Early bloom (late February)



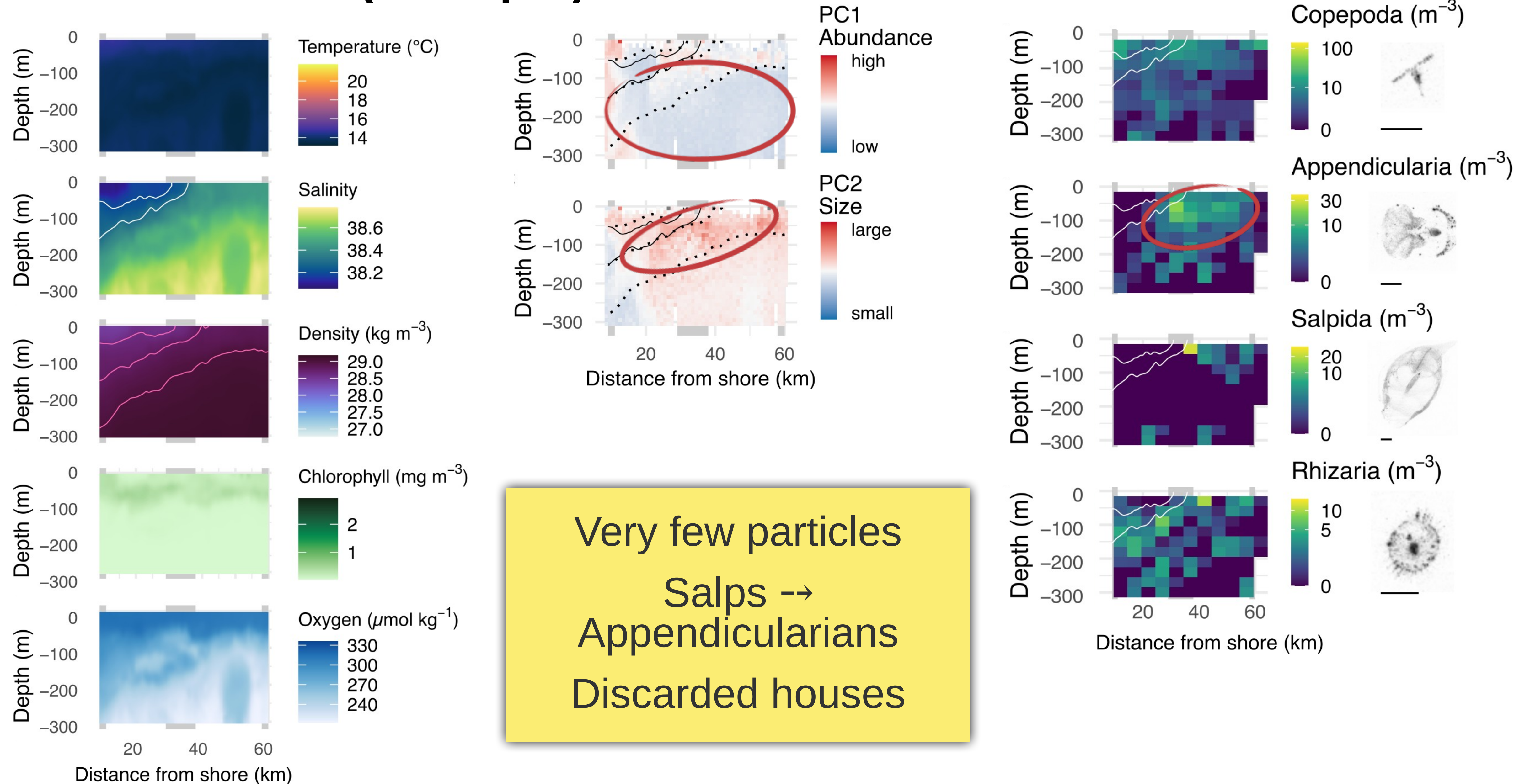


# 2: Mid bloom (late March, windy weather)



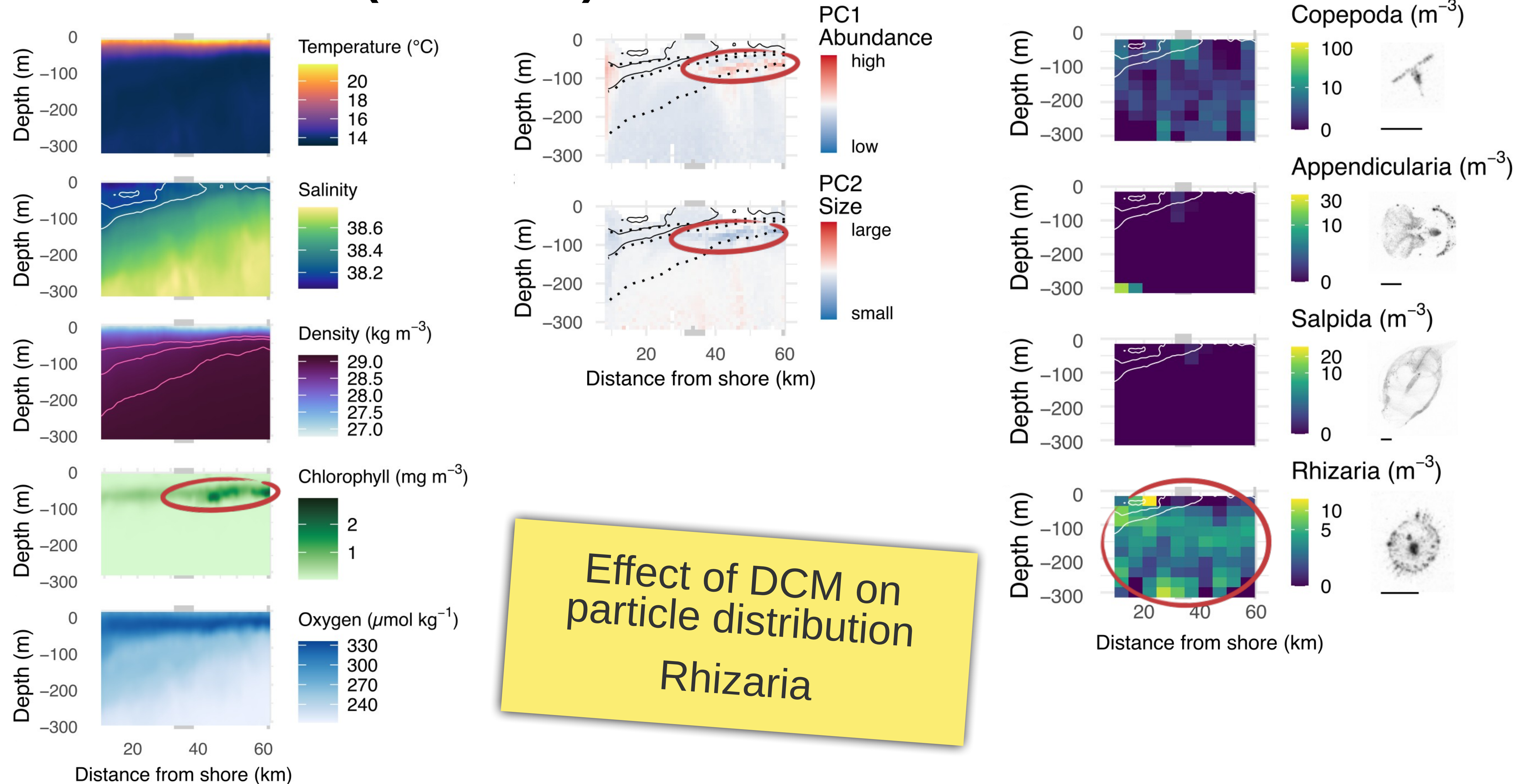


# 3: Late bloom (late April)





# 4: Post bloom (late June)





# Limitations

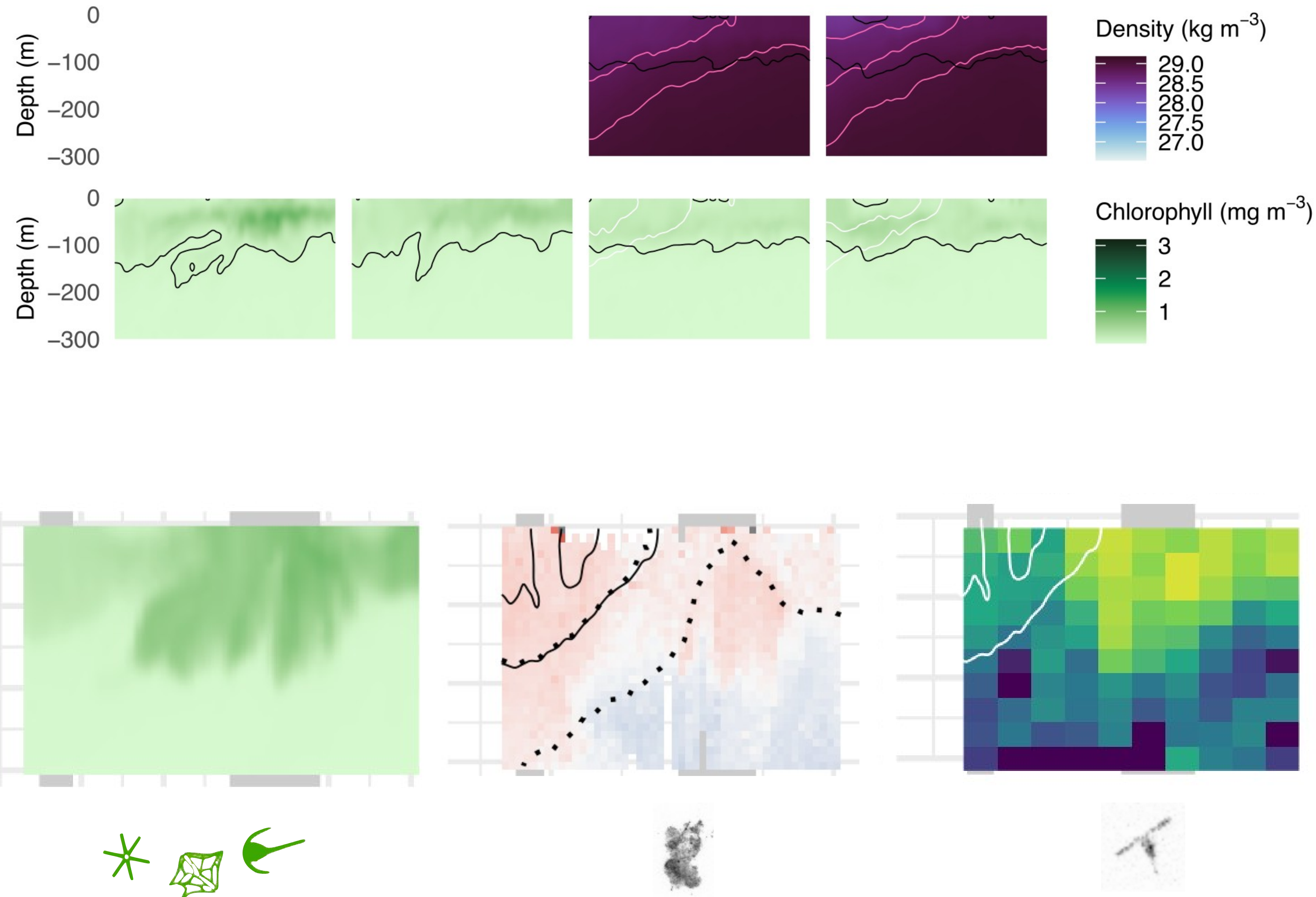
Some **instrument failure** (e.g. no CTD for ~15 days)

Limited **taxonomic** resolution from images and **imperfect** automated classification (>90% total accuracy but ~70% on living organisms)

**Not enough organisms**  $\implies$  lower resolution in biological concentrations than in particles/biogeochemistry

sampling rate of 0.25L/s but oligotrophic area

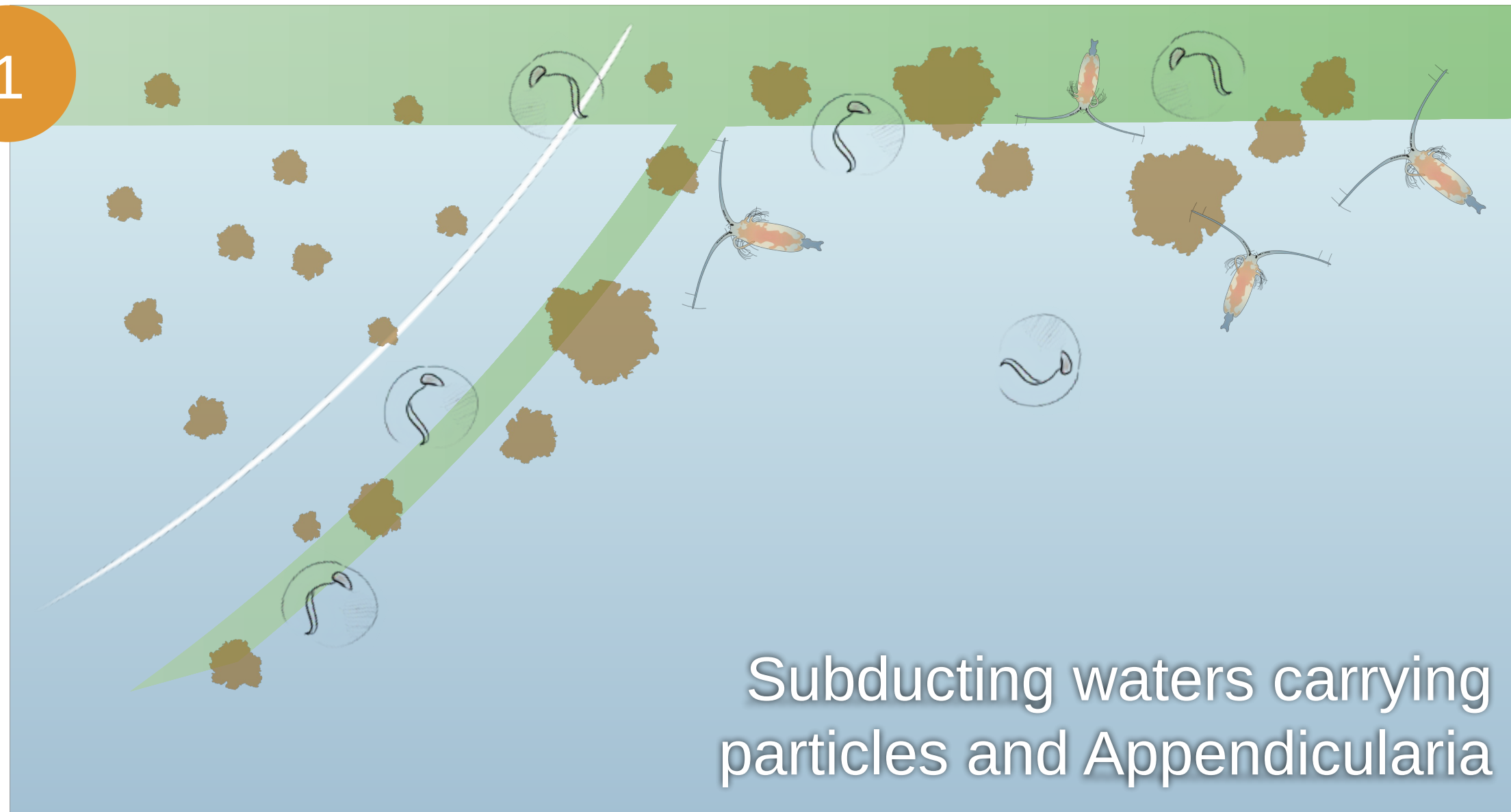
solution: UVP6 HF = less autonomy but higher sampling rate



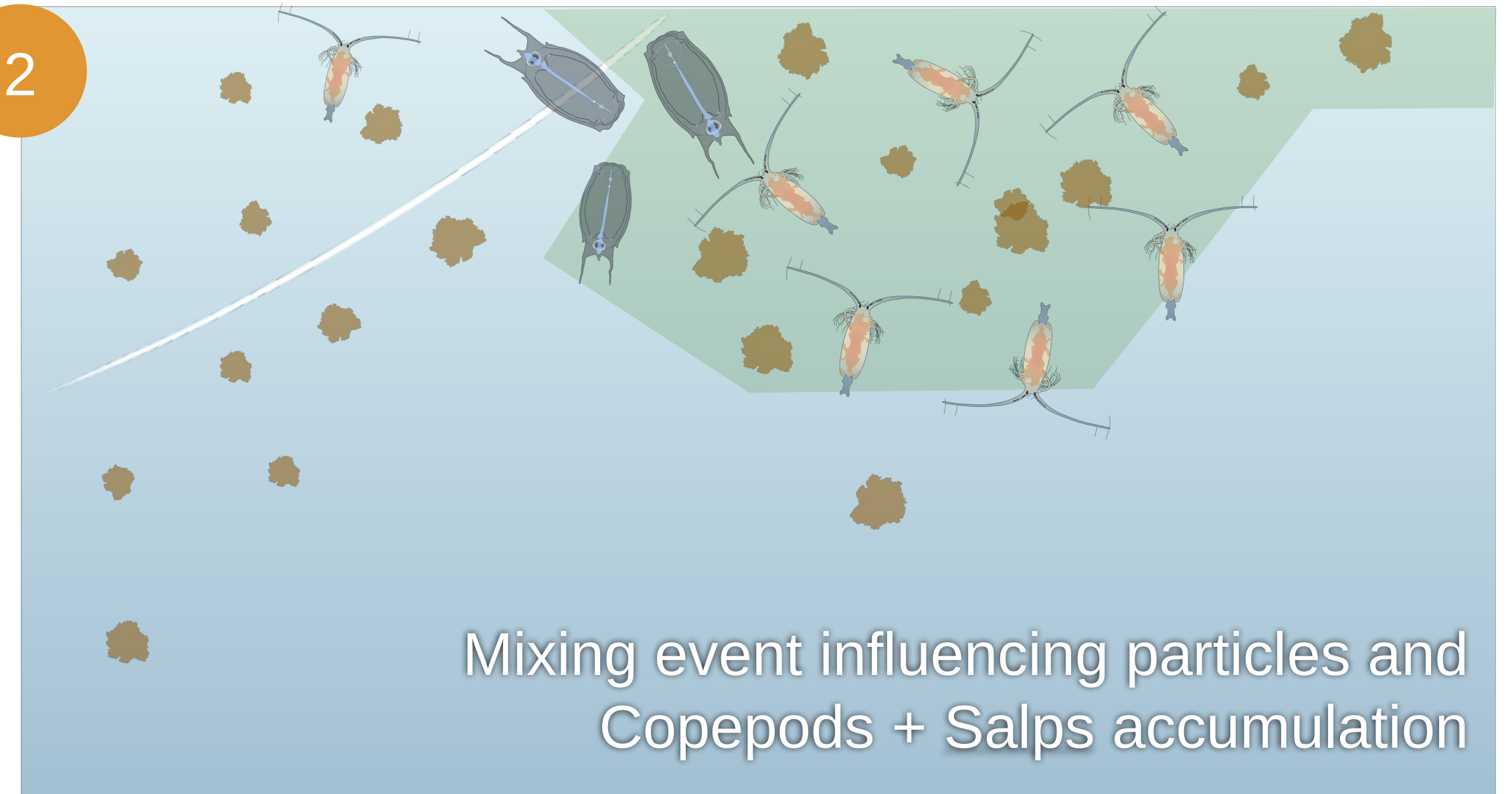


# Summary: bloom dynamics

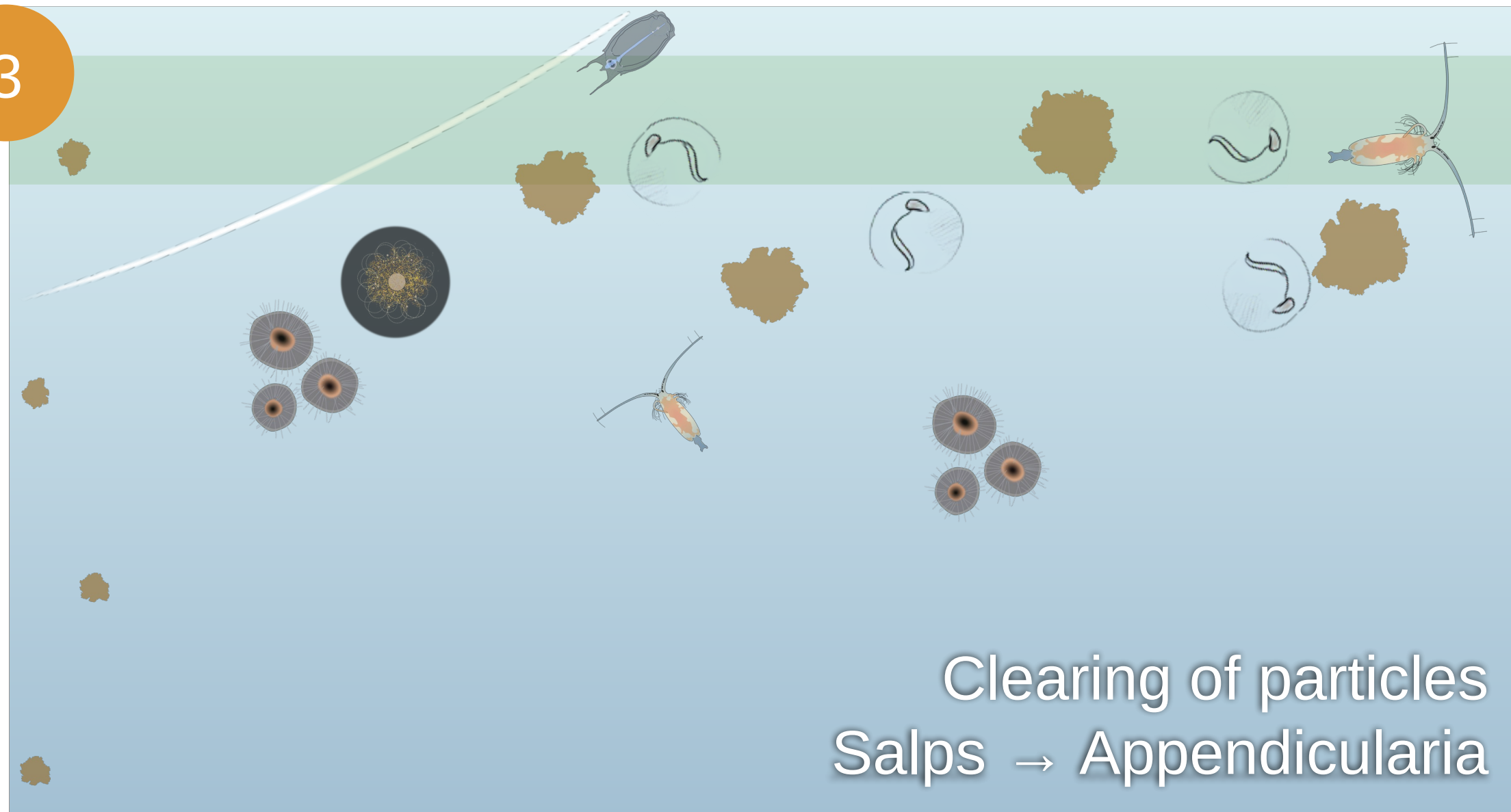
1



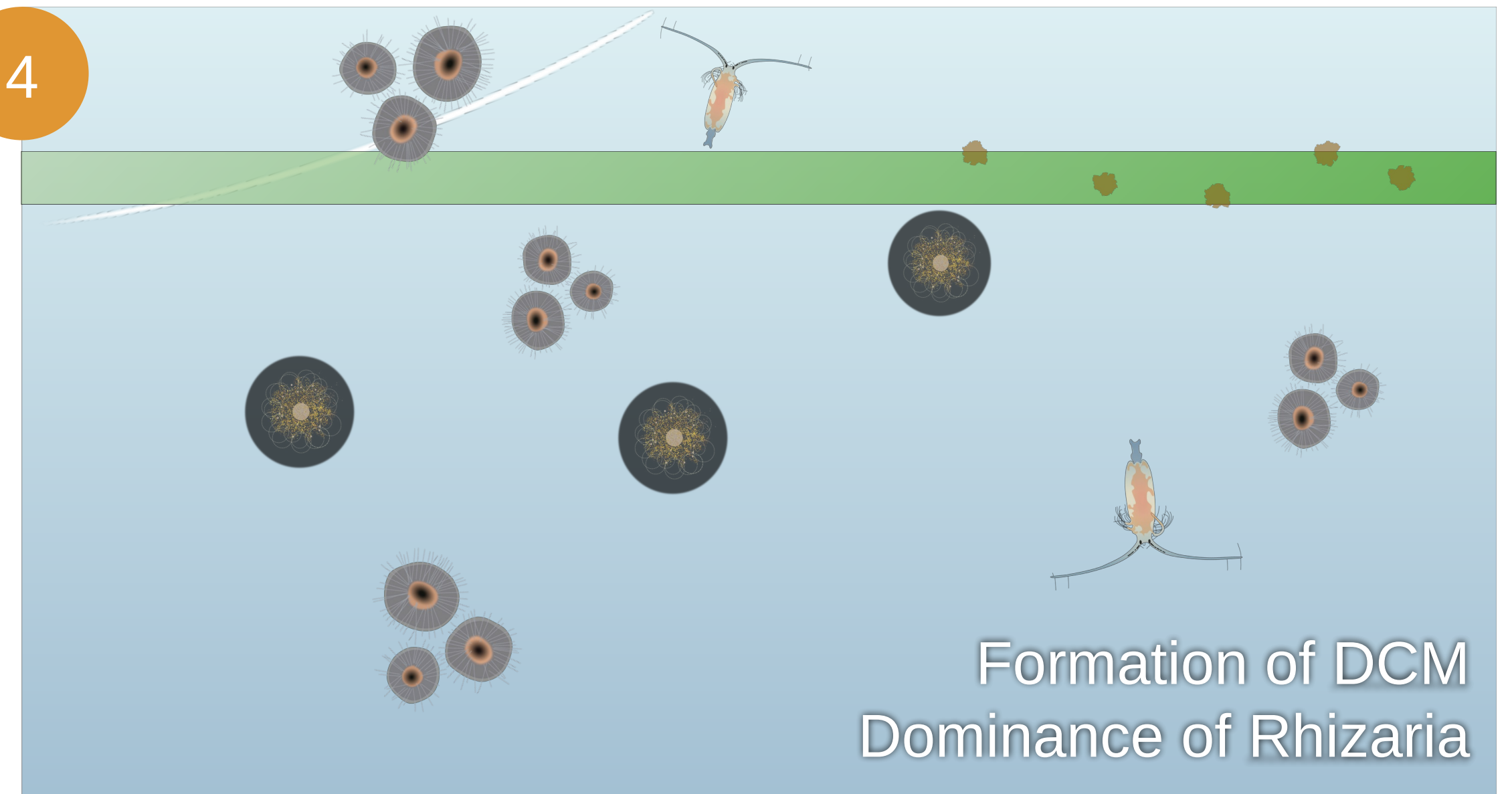
2



3



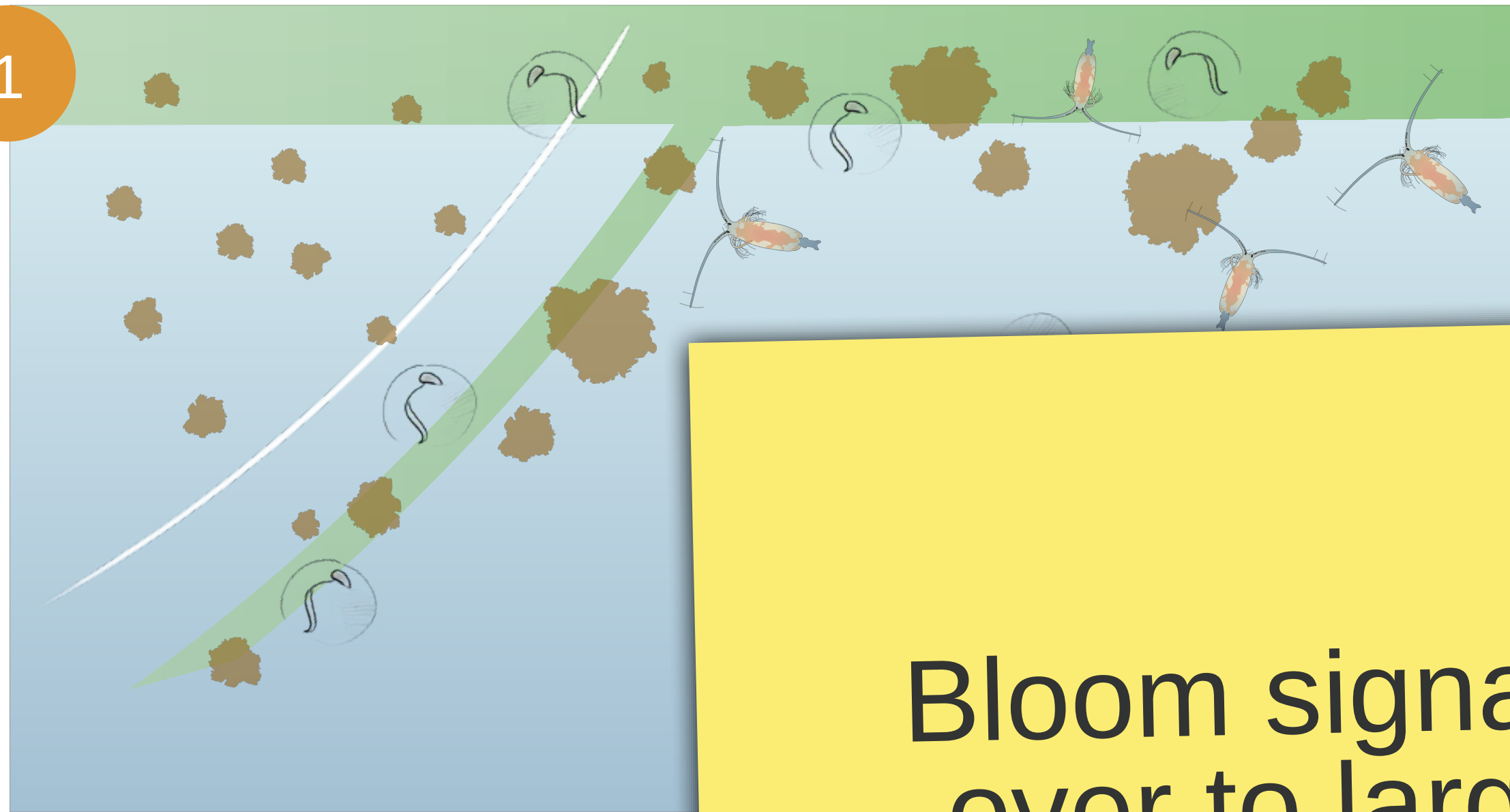
4





# Summary: bloom dynamics

1

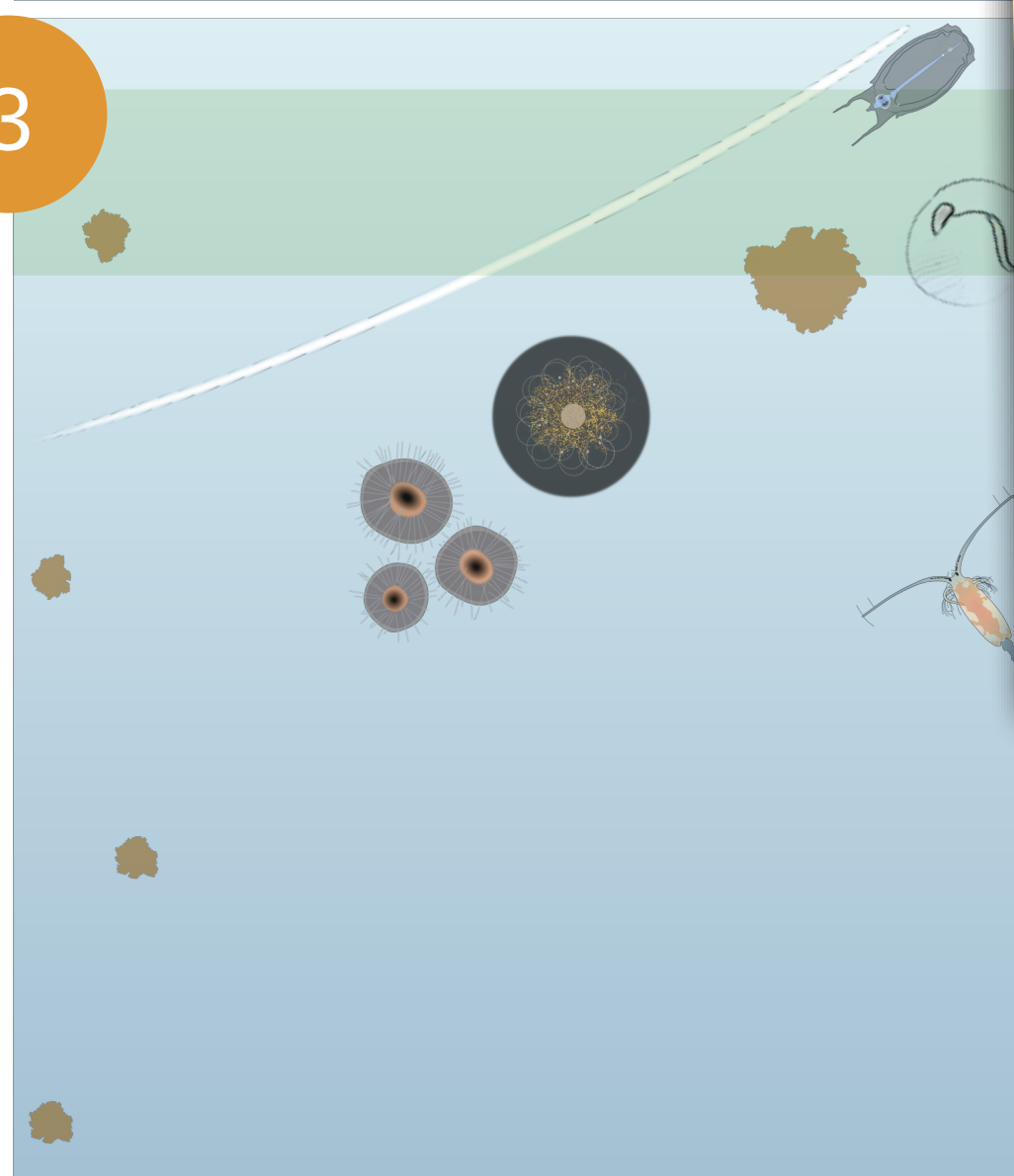


2

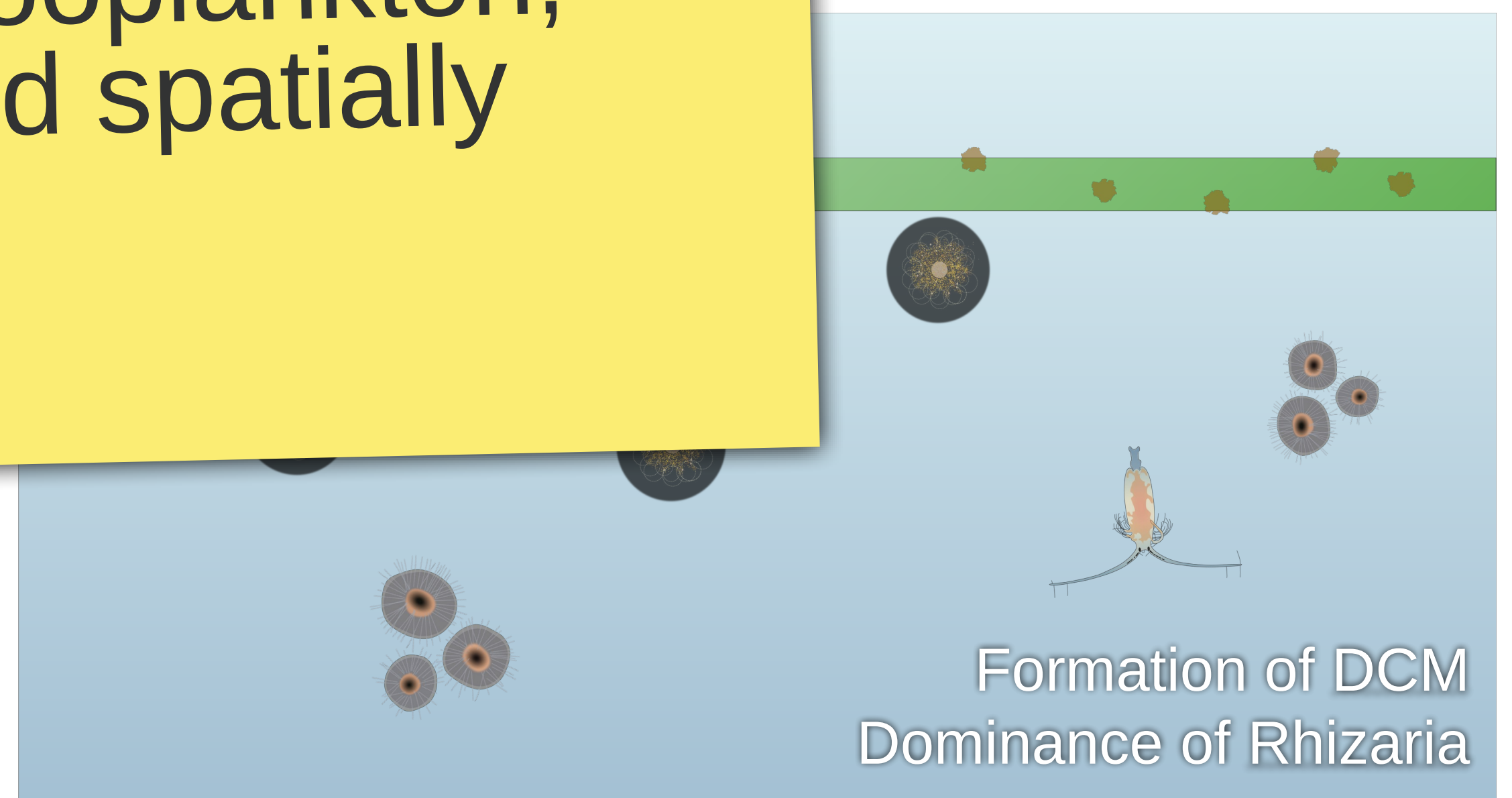


influencing particles and  
ds + Salps accumulation

3



Clearing of particles  
Salps → Appendicularia



Formation of DCM  
Dominance of Rhizaria

Bloom signal rapidly carries  
over to large zooplankton,  
temporally and spatially





# Thank you

# WWW.PIC



**BELMONT**  
**F O R U M**

